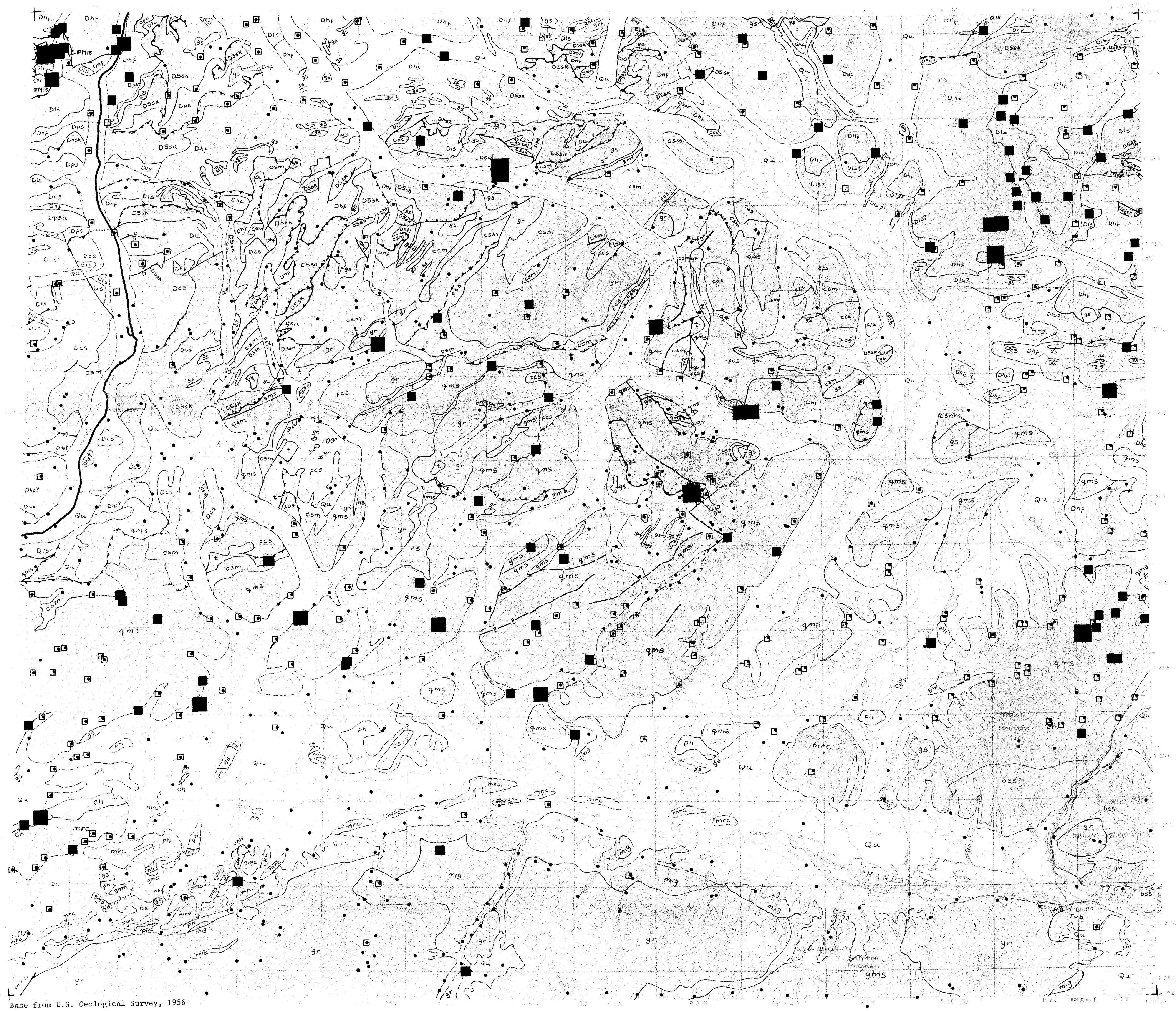
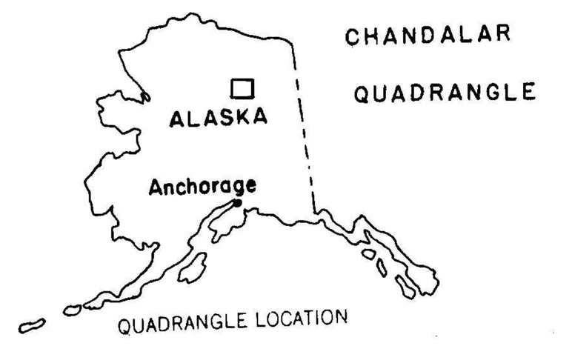
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-878E
FOLIO OF THE CHANDALAR QUAD., ALASKA
Geochemical map, Zn

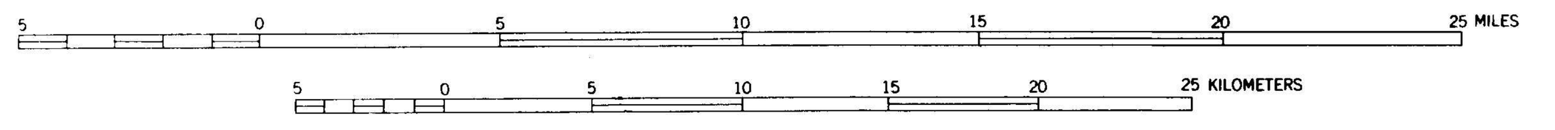


Base from U.S. Geological Survey, 1956

Data compiled, 1975-77



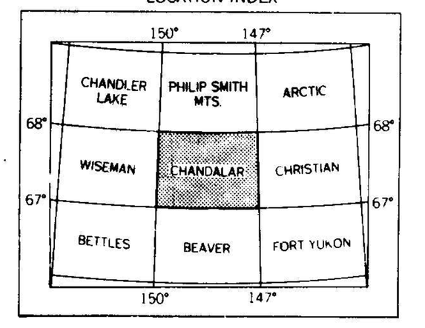
QUADRANGLE LOCATION



CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

1958 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 28°30' TO 30°30' EAST

LOCATION INDEX



GEOCHEMICAL AND GENERALIZED GEOLOGIC MAP SHOWING DISTRIBUTION AND ABUNDANCE OF ZINC IN STREAM SEDIMENTS IN THE CHANDALAR QUADRANGLE, ALASKA

By

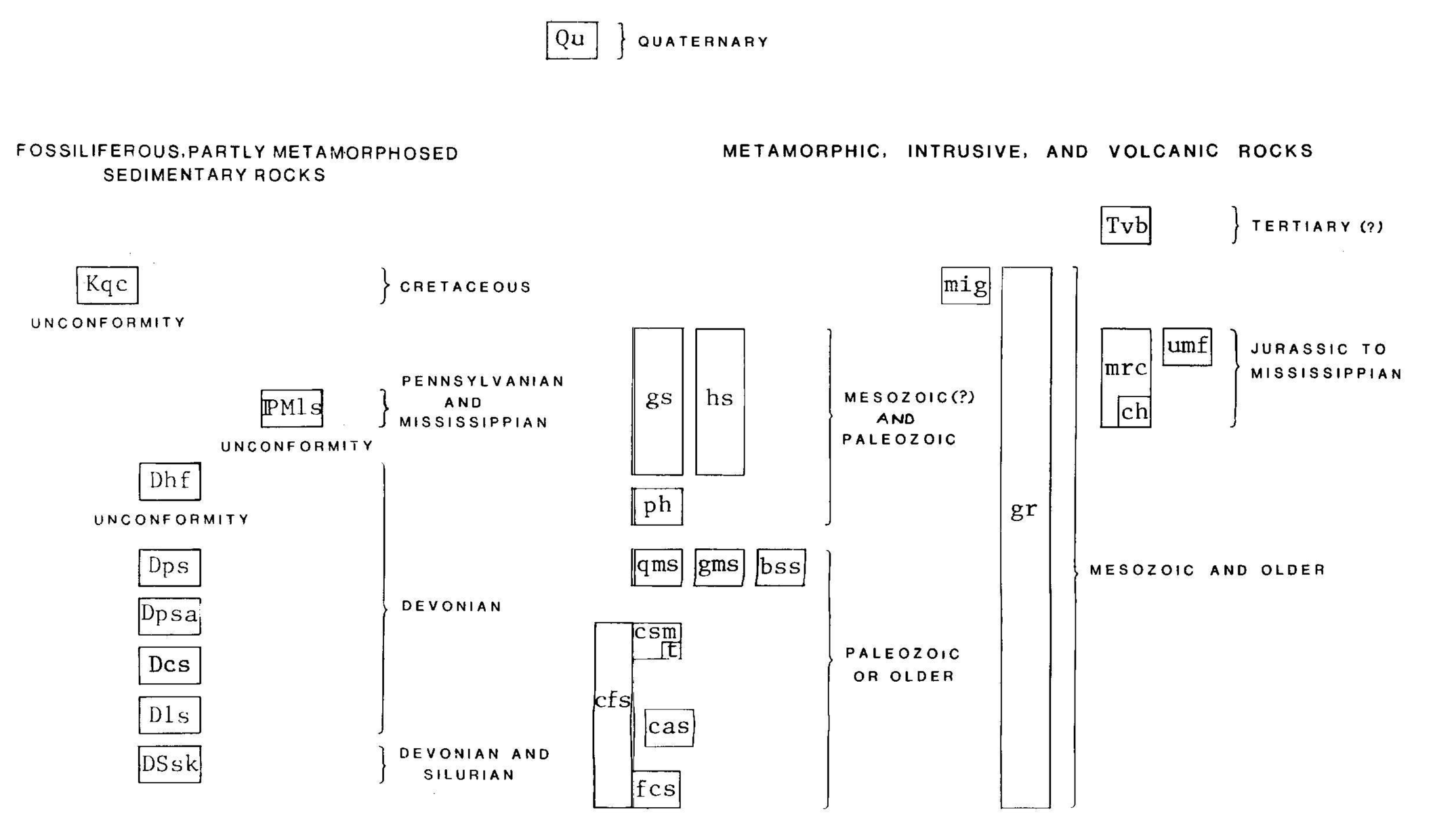
S. P. Marsh, D. E. Detra, and S. C. Smith

1978

EXPLANATION

GEOLOGY GENERALIZED AND REVISED FROM BROSGE AND REISER, 1964, AND CHIPP, 1970

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

This map is generalized from Brosgé and Reiser (1964). Many of these map units are combinations of units shown separately on the older map. The Devonian and Devonian(?) age that was assigned to the metamorphic rocks by Brosgé and Reiser (1964) is herein revised to early Paleozoic or older.

SURFICIAL DEPOSITS

- **Qu** Unconsolidated sedimentary deposits (Quaternary)

FOSSILIFEROUS PARTLY METAMORPHOSED SEDIMENTARY ROCKS

- **Kqc** Quartz pebble conglomerate (Cretaceous)
- **PMls** Lisburne Group (Pennsylvanian and Mississippian) and Kayak Shale (Mississippian)--Limestone, dolomite, shale and conglomerate
- **Dhf** Hunt Fork Shale (Upper Devonian)--Slate and phyllite
- **Dps** Purple and green slate and phyllite (Devonian)
- **Dpsa** Purple and green andesitic volcanic sheared conglomerate (Devonian)
- **Dcs** Chloritic siltstone and grit (Devonian)--Schistose; in part graywacke
- **Dls** Limestone and siltstone (Upper Devonian)--Schistose; includes some green slate locally
- **DSsk** Skajit Limestone (Upper and Middle Devonian, Upper Silurian)--Limestone, dolomite, and marble

METAMORPHIC, INTRUSIVE AND VOLCANIC ROCKS

- **Tvb** Vesicular olivime basalt flows (Tertiary?)
- **mig** Migmatite--Intercalated mica schist and granite; granite with mafic inclusions
- **gr** Granitic rocks--K/Ar dates of biotite are 101 m.y. and 125 m.y. (Brosgé and Reiser, 1964); of hornblende, 486 m.y. (M. L. Silberman and D. L. Turner, written commun., 1977)
- **mrc / ch** Mafic rocks and chert--Pillow basalt, andesite, minor chert; diorite; diabase and gabbro. Chert (ch) differentiated where abundant
- **umf** Ultramafic rocks
- **gs** Greenstone and greenschist--Includes pillowed flows in Hunt Fork Shale (Dhf) in northeast part of the quadrangle
- **hs** Hornblende schist--Mostly hornfels facies
- **ph** Phyllite and schistose wacke
- **qms** Quartz muscovite schist
- **gms** Garnet mica schist--Mostly hornfels facies
- **bss** Biotite staurolite schist--Hornfels facies
- **csm / t** Calcareous schist, marble and tactite (t) locally
- **cfs** Undifferentiated calcareous schist (csm) and feldspathic chloritic schist (fcs)
- **fcs** Feldspathic chloritic schist--Includes metadiorite sills and pyritic quartzite
- **cas** Chloritized amphibole schist--Local remnant glaucophane

GEOLOGIC SYMBOLS

CONTACT--Dashed where approximate; dotted where concealed

NORMAL FAULT--Dashed where inferred, queried where doubtful; dotted where concealed; U, upthrown side; D, downthrown side

THRUST FAULT--Queried where doubtful; dotted where concealed. Sawteeth on upper plate

GEOCHEMICAL SYMBOLS

- Sample locality
- Anomalous values of zinc less than 150 PPM
- Anomalous values of zinc

DISCUSSION

This geochemical map shows the distribution and abundance of zinc in -80 mesh (177 micrometers) stream sediment samples in the Chandalar quadrangle, Alaska. The map is one of a series of geochemical maps that together with the background information circular (Reiser and others, 1978) comprise the folio on the Chandalar quadrangle, Alaska. The data are plotted on a subdued base map showing the generalized geology, topography, and sample localities. Map symbols show the metal values that are considered anomalous; these symbols are defined on the accompanying histograms. An explanation of sampling, preparation, and analytical procedures and the geochemical raw data for all samples are presented by O'Leary and others (1976). The -80 mesh (177 micrometers) stream sediment medium was used in this study because of the regional setting in the north-central Brooks Range. Given the rather restrictive time and manpower constraints the -80 mesh (177 micrometers) stream sediment combined with panned concentrates was determined to be the most economical and adequate medium in this case, where clastic sediments are being derived from local bedrock.

The study area is one of generally high relief with short fast-moving streams and broad glacial valleys. All samples were taken from active streams, as close to the center channel as possible. All sediments were considered to be locally derived. Care was taken, when sampling an obviously glaciated terrane, to sample above or upstream from morainal material, wherever possible. Most samples were taken in areas where bedrock was within 30 m of the sample site.

Due to the poor sensitivity for zinc by spectrographic analysis (200 ppm) all zinc analyses were done by atomic absorption.

STATISTICAL DATA

There are four sections of statistical data included with this map: 1) A histogram shows frequency (number of samples) plotted against concentration of zinc in ppm (parts per million). A short table of statistical information is included with the histogram. 2) A correlation diagram shows correlation coefficients in decimal fractions of 1 in the upper part and the number of sample pairs used in the correlation in the lower part. The correlation coefficients and number of sample pairs for zinc are shaded on the diagram. A coefficient of 1 indicates a perfect direct proportional relation, -1 an inverse relation. 3) A cumulative frequency plot shows cumulative frequency plotted against concentration of zinc in ppm. 4) A perspective plot shows a three-dimensional representation of anomalous zinc in the Chandalar quadrangle. A grid was arbitrarily applied to the quadrangle; the metal values of samples in each grid were averaged to give the best representation of zinc values. The peaks shown reflect this average. The plateau in the zinc perspective plot represents an arbitrary cut-off level of 100 ppm, above which all samples were considered anomalous.

GEOCHEMISTRY OF ZINC

Zinc is a strongly chalcophile element with weak lithophile tendencies. Zinc crystallizes late in magmatic differentiates and is often found intruding surrounding rocks (Rankama and Sahama, 1955). Cadmium is chemically very similar to zinc and is often a constituent of the zinc sulfide mineral sphalerite. In the Chandalar quadrangle no cadmium was reported from the stream-sediment samples, but a number of nonmagnetic panned concentrate samples contained detectable cadmium (>50 ppm Cd) (Detra and others, 1977). Zinc readily goes into solution as the sulfate or chloride during weathering and may be transported considerable distances. Zinc is often precipitated in sulfur-bearing muds and organic-rich shales and many of the areas of anomalous zinc in the Chandalar quadrangle are in the Hunt Fork Shale (Dhf).

OCCURRENCES

Since the Chandalar quadrangle contains the possible extension of the southwestern Brooks Range copper belt (Hawley, 1976), zinc was considered an important pathfinder element for the geochemical expression of potential sulfide deposits. Zinc's ubiquitous nature for shales is seen by the numerous occurrences in the Upper Devonian Hunt Fork Shale (Dhf) along the northern border and extending down the northeast side of the map. Another belt of anomalous zinc trends roughly east-west in the central part of the quadrangle in the quartz-muscovite schist (qms) unit.

There are two main anomalous zinc areas in the Hunt Fork Shale (Dhf). One is in the northwest corner of the map and is associated with anomalies in copper and molybdenum (Marsh and others, 1978a). Rock samples taken from the stream containing the largest anomalies in this area (table 1) were not anomalous in any element including zinc that was analyzed for; this would indicate that the source of the anomalies is off the map to the west, possibly from a massive sulfide type of deposit. The other, and more extensive area of anomalous zinc and other base metal anomalies (Marsh and others, 1978a) in the Hunt Fork Shale (Dhf), is in the northeast corner of the map. Here zinc anomalies flank both sides of the North Fork-East Fork Chandalar River draining a large area of Upper Devonian Hunt Fork Shale (Dhf) and smaller areas of an unnamed Upper Devonian limestone and siltstone unit (Dls). The contact zone between these Upper Devonian units and the underlying Skajit Limestone (DSsk) is noticeably mineralized in the adjacent Philip Smith Mountains quadrangle and the mineralization seen here may reflect the same contact zone. Mineralization in this area and a subdued aeromagnetic high may reflect a deeply buried pluton (Cady, 1978). Boron, lanthanum, and antimony anomalies also occur in the same area (Marsh and others, 1978b, c, and d) indicating a potential for skarn-type deposits (Boyle, 1974). The nonmagnetic fraction of panned concentrates from this area contain the only reported cadmium in the quadrangle and reinforce these anomalies (Detra and others, 1977).

TABLE 1.--*Semiquantitative spectrographic analyses of rock samples from the Hunt Fork Shale Chandalar quadrangle, Alaska*

[Analyst, G. W. Day. Concentration in parts per million (ppm). N, not detected]

SAMPLE	ELEMENT Cu	Mo	Pb	Zn
CH032RA	30	N	20	130
CH032RB	30	N	15	55
CH032RC	30	N	30	120

East-west trending zinc anomalies in the quartz-mica schist (qms) unit are scattered and diffuse although many coincide with other base metal anomalies (Marsh and others, 1978a). One area of clustered zinc anomalies in quartz-mica schist (qms), occurs near the east border of the map south of Chekhechunnjik Creek. This coincides with copper anomalies (Marsh and others 1978a) as well as anomalies in arsenic, molybdenum, silver, and antimony in the nonmagnetic fraction of panned concentrates (Detra and others, 1977) and may represent mineralization along a fault or shear zone (Brosgé, oral commun., 1976). Scattered zinc anomalies occur in the central southwest area of the map near the O'Keefe Hills and are associated with copper and molybdenum anomalies (Marsh and others, 1978a). Nonmagnetic panned concentrates from this area also contain anomalous amounts of copper, lead, molybdenum, and tin (Detra and others, 1977) and may represent a continuation of mineralization along strike from the Geroe Creek area discussed below; there is a possibility of concealed mineralized intrusives.

Zinc also occurs in three other areas on the map: 1) Three anomalous zinc values in the southwest corner of the map, just north of the South Fork Koyukuk River, occur in mafic rocks and chert (mrc) including volcanic rocks and may represent normal zinc contents for these materials. 2) Some of the largest zinc values on the map occur with lead anomalies along the North Fork Chandalar River just west of Thru Creek (T. 35 N., R. 5 W.) and represent a northerly extension of the skarn-type deposit at Big Spruce Creek (Marsh and others, 1978a, Marsh and Wiltse, 1978). In field checking the zinc anomalies, small veins of galena in altered Skajit Limestone (DSsk) were found. 3) Weak zinc anomalies occur around the Geroe Creek altered zone associated with molybdenum, copper, and lead (Marsh and others, 1978a).

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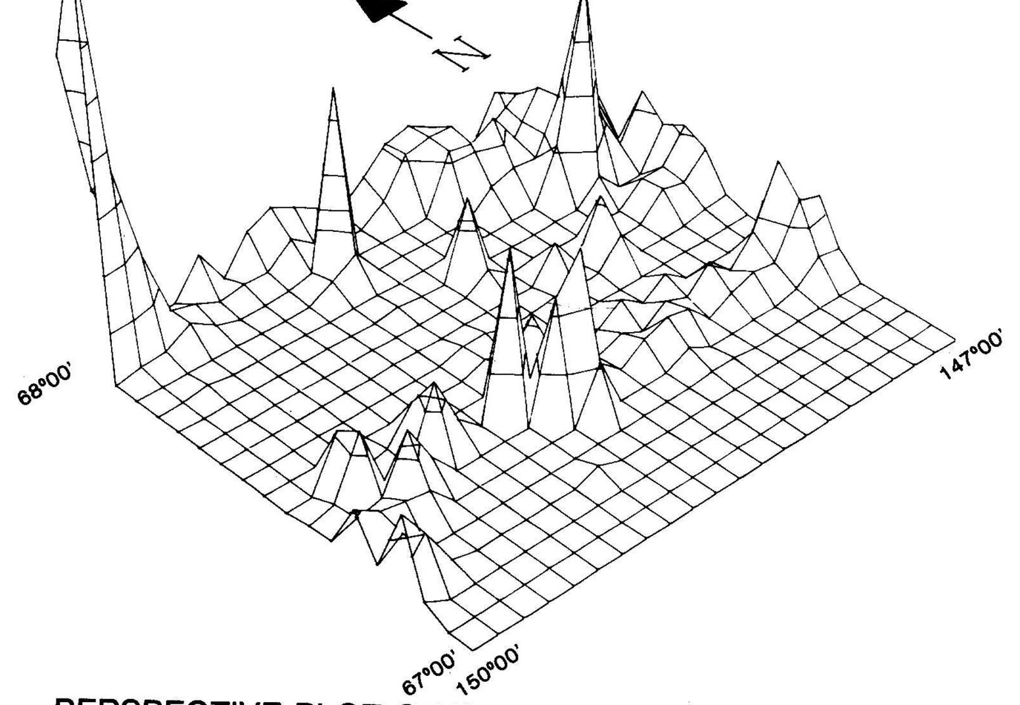
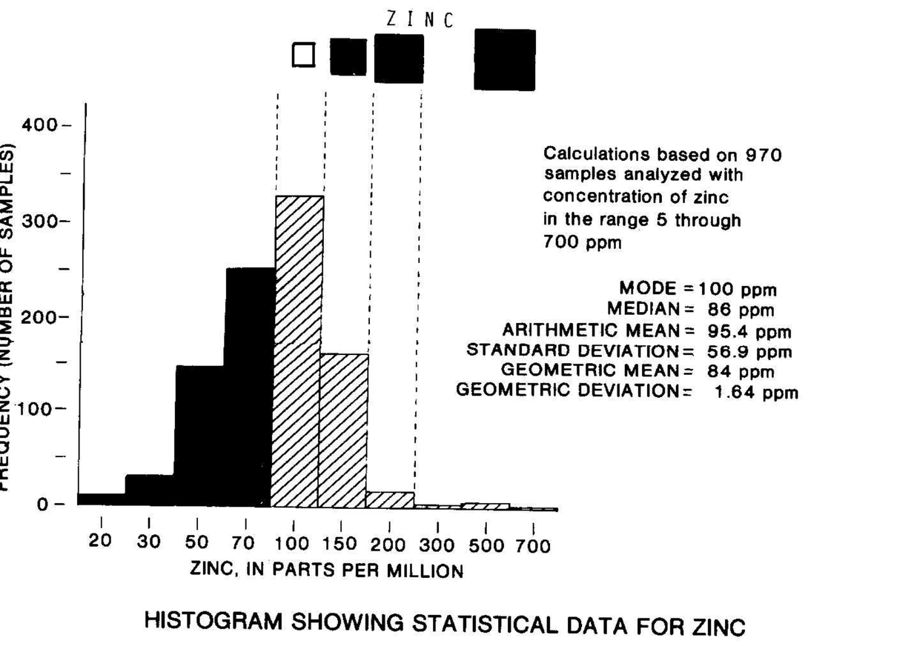
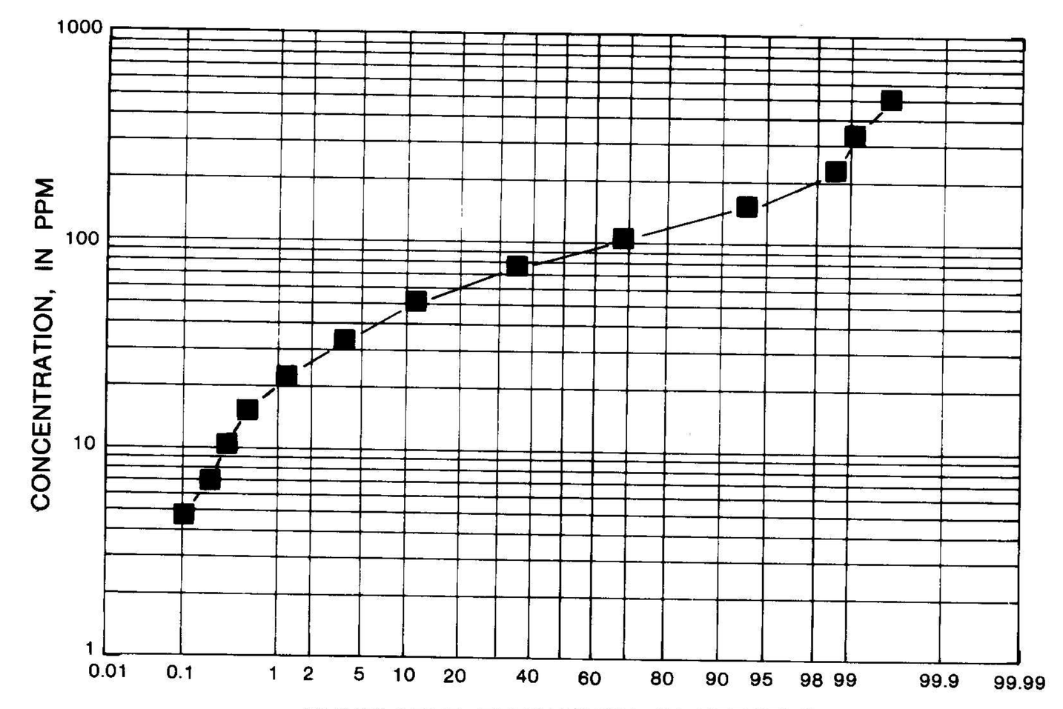


PERSPECTIVE PLOT OF ZINC IN STREAM SEDIMENTS
CHANDALAR QUADRANGLE, ALASKA



HISTOGRAM SHOWING STATISTICAL DATA FOR ZINC



CUMULATIVE FREQUENCY PLOT FOR ZINC (■) IN STREAM SEDIMENTS, CHANDALAR QUADRANGLE, ALASKA

CORRELATION COEFFICIENT

		Six-step semiquantitative spectrographic analysis											Atomic absorption analysis		Colorimetric analysis
		B	BA	CO	CU	LA	MO	NB	NI	PB	V	Y	ZN	SB	AS
Six step semiquantitative spectrographic analysis	B		-.05	.24	.21	.04	.07	-.11	.26	-.02	.14	.09	.40	.17	-.06
	BA	962		.29	.12	.11	-.30	.17	.06	.27	.51	.14	.25	.08	.21
	CO	897	909		.27	.08	.07	.07	.51	.22	.35	.22	.42	.09	-.17
	CU	962	975	909		.12	.29	.01	.47	.31	.27	.14	.35	.20	-.08
	LA	750	759	716	759		.20	.16	.10	.22	.14	.40	.05	-.04	-.02
	MO	44	45	37	39	39		-.38	.43	.003	.25	.34	.25	.22	.04
	NB	411	417	416	416	414	14		.01	.13	.19	.36	-.19	-.01	.28
	NI	963	976	909	977	760	41	418		.23	.40	.29	.43	.20	-.23
	PB	889	900	872	902	707	41	412	902		.19	.27	.24	.15	.20
	V	963	976	909	977	760	46	417	978	902		.32	.24	.11	-.05
	Y	921	932	881	932	731	41	413	933	873	933		.002	-.03	-.10
Atomic absorption analysis	ZN	950	963	897	964	752	46	413	965	890	965	929		.36	.01
	SB	797	808	805	807	631	29	389	808	802	808	792	801		.14
Color. anal.	AS	229	229	171	231	161	21	27	231	163	231	198	228	112	

NUMBER OF SAMPLE PAIRS

CORRELATION DIAGRAM FOR ZINC IN STREAM SEDIMENTS
CHANDALAR QUADRANGLE, ALASKA

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